

AMES LABORATORY CHRONIC BERYLLIUM DISEASE PREVENTION PLAN (CBDPP)

This plan meets the requirements for a written Chronic Beryllium Disease Prevention Plan (CBDPP) stated in 10 CFR Part 850 – Chronic Beryllium Disease Prevention Program. The plan describes existing conditions at Ames Laboratory and the procedural controls that ensure employee protection from beryllium exposures that may cause adverse health effects such as berylliosis and chronic beryllium disease.

1.0 APPROVAL RECORD

- **Reviewed by:** Document Control Coordinator (Hiliary Burns)
- **Approved by:** Manager, Purchasing and Property Services (Andrea Spiker)
- **Approved by:** Manager, Facilities and Engineering Services (Doug Hoenig)
- **Approved by:** Manager, ESH&A (Sean Whalen)
- **Approved by:** Legal Counsel (Barbara Biederman)
- **Approved by:** Assistant Director for Scientific Planning (Cynthia Jenks)
- **Approved by:** Chief Research Officer (Dimitri Argyriou)
- **Approved by:** Chief Operations Officer (Mark Murphy)
- **Approved by:** Deputy Director (Thomas A. Lograsso)
- **Approved by:** Laboratory Director (Adam Schwartz)

The official approval record for this document is maintained by the Training and Documents Office, 105 TASF.

2.0 REVISION/REVIEW INFORMATION

The revision description for this document is available from and maintained by the author.

3.0 PURPOSE AND SCOPE

The Ames Laboratory is a government-owned, contractor-operated national laboratory of the U.S. Department of Energy (DOE), operated by and located on the campus of Iowa State University in Ames, Iowa. Approximately 745 people are involved with the Laboratory either as full- or part-time employees or as Laboratory associates. Key areas of expertise are materials design, synthesis and processing; analytical instrumentation design and development; materials characterization; catalysis; computational chemistry; condensed matter theory; and computational materials science and materials theory.

The Laboratory is committed to preventing accidental loss of resources and assets and protecting the general public and the environment through the prevention of pollution, property loss, or damage to the environment. Therefore, it is our goal to eliminate foreseeable hazards and maintain a safe and healthful workplace. Complying with applicable Laboratory Contract requirements, Department of Energy Orders, and regulatory standards is a prerequisite for conducting Laboratory business and the responsibility of each employee.

In order to accomplish these goals, the Laboratory has incorporated the principles of Integrated Safety Management (ISM) and the practices of an Environmental Management System (EMS) into the [Laboratory's Integrated Safety Management System \(ISMS\)](#).

This plan establishes a chronic beryllium disease prevention program (CBDPP), a component of the ISMS.

3.1 Definitions

The DOE standard contains definitions in section 850.3. Select terms and their meanings critical to understanding beryllium usage at Ames Laboratory are given below:

Beryllium: Elemental beryllium and any insoluble beryllium compound or alloy containing 0.1 percent beryllium or greater that may be released as an airborne particulate.

Beryllium activity: An activity that can expose workers to airborne beryllium, including but not limited to design, construction, operation, maintenance, or decommissioning, and which may involve one DOE facility or operation or a combination of facilities and operations.

Beryllium article: A manufactured item that is formed to a specific shape or design during manufacture, that has end-use functions that depend in whole or in part on its shape or design during end use and that does not release beryllium or otherwise result in exposure to airborne concentrations of beryllium under normal conditions of use.

Beryllium-associated worker: A current worker who is or was exposed or potentially exposed to airborne concentrations of beryllium at a DOE facility, including: (1) A beryllium worker; (2) A current worker whose work history shows that the worker may have been exposed to airborne concentrations of beryllium at a DOE facility; (3) A current worker who exhibits signs or symptoms of beryllium exposure; and (4) A current worker who is receiving medical removal protection benefits.

Beryllium worker: A current worker who is regularly employed in a DOE beryllium activity.

Worker: A person who performs work for or on behalf of DOE or the Ames Laboratory, including a DOE employee, an independent contractor, a DOE contractor or subcontractor employee, or any other person who performs work at a DOE facility.

Given the above definitions of “beryllium activity” and “beryllium-associated worker”, Ames Laboratory considers all current Facilities and Engineering Services (FES) personnel as “beryllium associated workers” and subject to the provisions of this plan.

3.2 Enforcement

The DOE may take appropriate steps under its contracts with DOE contractors to ensure compliance with this part. These steps include, but are not limited to, contract termination or reduction in fee.

3.3 Applicability

Beryllium was regularly used at Ames Laboratory during the 1940's and early 1950's. Documentation shows that several Ames Laboratory employees were exposed to beryllium during activities that generated measurable ambient concentrations of beryllium-containing dust. Since the early 1950's, beryllium has been used infrequently at the Laboratory and under conditions that were not expected to generate significant exposure potential. Today, Ames Laboratory conducts very limited research involving beryllium-

containing materials or beryllium articles (see definitions). Section 5.0 provides an overview of where beryllium is found at Ames Laboratory.

The DOE standard Part 850 – Chronic Disease Prevention Program applies to the following situations:

- DOE offices responsible for operations or activities that involve present or past exposure, or the potential for exposure, to beryllium at DOE facilities;
- DOE contractors with operations or activities that involve present or past exposure, or the potential for exposure, to beryllium at DOE facilities; and
- Any current DOE employee, DOE contractor employee, or other worker at a DOE facility who is or was exposed or potentially exposed to beryllium at a DOE facility.

The DOE standard does not apply to the following situations:

- Beryllium articles; and
- DOE laboratory operations that meet the definition of laboratory use of hazardous chemicals in 29 CFR 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories.

3.4 Exposure Groups

Beryllium usage resulted in contamination of several Ames Laboratory buildings. Annual reports of beryllium sampling and characterization studies conducted, if any, are compiled each March for the previous year. These reports can be found at: <http://www.ameslab.gov/operations/esha/beryllium-information>. Consideration of the data collected to date suggests 4 exposure groups that are summarized as follows:

General Public: These are individuals located outside the Ames Laboratory buildings on the campus of Iowa State University.

Beryllium Exposure Potential: Negligible. Environmental testing conducted in accordance with protocols established by the Environmental Protection Agency showed ambient levels of beryllium well below standards established by the Clean Air Act.

Ames Laboratory Visitors: Ames Laboratory has a variety of visitors including school/civic groups, visiting scholars/scientists and contract personnel such as equipment repair staff.

Beryllium Exposure Potential: Negligible. Air sampling in occupied areas of the Laboratory has consistently shown non-detectable ambient levels of airborne beryllium.

Research Staff: Individuals who occupy and conduct work in offices and laboratories in any Ames Laboratory building.

Beryllium Exposure Potential: Minimal. Extensive surface testing has shown several cases of beryllium contamination above Department of Energy release limits in isolated areas of occupied spaces. In general, these surfaces are physically inaccessible (e.g. the top of a ceiling-mounted ventilation duct) or remotely located (e.g. the inside of a piece of equipment).

Facilities/Operational Staff: Laboratory personnel responsible for maintenance and renovation activities associated with Ames Laboratory buildings.

Beryllium Exposure Potential: Minimal. FES activities are conducted under approved Readiness Review. Activities with potential to interact/disturb areas with legacy beryllium surface contamination are identified and reviewed for exposure potential. Procedures have been implemented that require the use of exposure controls (e.g. ventilation and/or personal protective equipment) that have been tested and confirmed to reduce exposure potential to a minimal level.

4.0 ROLES AND RESPONSIBILITIES

Roles and responsibilities as they apply to implementation of the CBDPP are as follows:

4.1 Laboratory Director

The Director is the champion for Integrated Safety Management and is directly responsible for the safety and security of the Laboratory's employees and assets. The Director delegates this authority to line management as described below.

4.2 Deputy Director

The Deputy Director supervises the Environment, Safety, Health and Assurance (ESH&A) department. In this role, the Deputy Director works with the Safety Review Committee to ensure the Conduct of Research program is robust and utilizes principles of Integrated Safety Management.

4.3 Division, Institute and Program Directors and Department Managers (DD/ID/PD/DM)

DD/ID/PD/DMs are responsible for personnel, safety, oversight and management of space and property. In this role, they shall be aware of all environmental, safety and health issues associated with the use of beryllium at Ames Laboratory. Programs Directors shall assure that all Group Leaders within their program are aware of issues related to work with beryllium and that all work is approved by the Safety Review Committee via the Readiness Review process.

4.4 Group Leader

Group Leaders' safety management responsibilities require that they be aware of beryllium or beryllium-containing compounds in their laboratory spaces and ensure that all laboratory work with beryllium is done in accordance with an approved Readiness Review. All work must be conducted using documented controls that reduce or eliminate exposure potential. The same requirement applies to all Facilities and Engineering Services work in areas with suspected beryllium contamination above DOE limits.

4.5 Employee

Employees working with beryllium shall be authorized by Group Leaders and shall have received appropriate training as determined through the Readiness Review process. Authorized users shall be documented and Occupational Medicine notified of new users.

4.6 Occupational Medicine

Occupational Medicine shall be responsible for addressing any medical surveillance or health concerns related to use of beryllium at Ames Laboratory. Occupational Medicine staff shall coordinate the submission of updated information to the beryllium registry.

4.6 Environment, Safety, Health & Assurance (ESH&A)

ESH&A shall serve as the Laboratory's point-of-contact on beryllium issues related to past work with beryllium, exposure monitoring, and other programmatic requirements such as the maintenance of the written program.

5.0 PROGRAM INFORMATION

5.1 Development and approval of the CBDPP (850.10)

This Ames Laboratory CBDPP was prepared by the ESH&A Industrial Hygienist, reviewed by the ESH&A Manager and Occupational Medicine Director and approved by the DOE Site Manager or his or her designee.

5.2 General CBDPP requirements (850.11)

The Ames Laboratory has chosen to apply this CBDPP to all work activities that may involve potential exposure to beryllium. Specifically, both research or development activities involving beryllium shall be covered by this plan as well as any facilities or engineering services activities that may involve potential for incidental exposure to beryllium dust, such as accessing interstitial areas that may have above background surface concentrations of beryllium. For specific information on how employee exposures will be minimized or eliminated, see Section 5.9.

5.3 Compliance (850.13)

Compliance with the CBDPP will be assessed annually by the ESH&A office at Ames Laboratory as a part of the review discussed in section 6.2.

5.4 Baseline beryllium inventory (850.20)

Beryllium and/or beryllium-containing materials currently located at Ames Laboratory are identified in Table 1.

5.5 Hazard Assessment (850.23)

A beryllium hazard assessment includes an analysis of existing conditions, exposure data, medical surveillance trends and the exposure potential of planned activities. The inventory table lists "Exposure Potential" in the last column.

5.6 Airborne & Surface Beryllium Limits (850.23)

Ames Laboratory does not anticipate any usage of beryllium that would result in significant airborne concentrations. All activities with potential for the generation of airborne beryllium will be evaluated by the ESH&A Certified Industrial Hygienist or a similarly qualified person. Such activities will be conducted using available engineering controls (ventilation) and appropriate personal protective equipment (PPE) (gloves, respirator, Tyvek, etc.). If previous representative air sampling results are found

Air monitoring results, if air concentrations are measured, will be interpreted relative to the applicable exposure limit. Airborne concentrations will be controlled to levels below the Permissible Exposure Limit (PEL) of 2.0 micrograms/cubic meter of air established by the Occupational Safety & Health Administration (OSHA). The PEL is expressed as an 8-hour time-weighted average limit.

There are no surface contamination limits established by OSHA. The DOE has established the following limits for surface contamination: 0.2 micrograms per 100 square centimeters of surface for “general release to the public”; 3.0 micrograms per 100 square centimeters of surface for continued use in a “beryllium facility”. Ames Laboratory will control surface contamination to as low as practicable, but in no case exceeding these levels.

5.7 Action Level (850.23)

Ames Laboratory will adhere to the action level established by the DOE of 0.2 micrograms/cubic meter of air, which will effectively serve to control levels to below the PEL discussed in Section 5.6. In the unlikely event that the action level is exceeded, Ames Laboratory will implement the provisions described in 850.23(b) including periodic monitoring, exposure reduction and minimization, establishment of regulated areas, provision of hygienic facilities, use of PPE and appropriate signage.

5.8 Exposure Monitoring (850.24)

All exposure monitoring for beryllium will be conducted by a Certified Industrial Hygienist or similarly qualified person in accordance with Section 850.24 of the regulation.

5.9 Exposure Reduction and Minimization (850.25)

Ames Laboratory does not have any beryllium operations involving routine exposure to airborne beryllium or beryllium compounds. All work with beryllium-containing materials and interactions with surfaces contaminated with beryllium will be conducted so as to reduce the likelihood of any exposure to the lowest possible level. Engineering controls will be utilized whenever feasible to control generation of ambient concentrations of beryllium and thereby eliminate potential exposures to employees. Administrative and personal protective equipment controls will also be used when indicated as means to reduce the likelihood of exposure.

The Ames Laboratory Beryllium Inventory is described in Table 1. For more details, including current group or activity leaders, the Readiness Review files may be consulted.

Table 1 – Ames Laboratory Beryllium Inventory

Type of equipment, locations	Beryllium (Be) Item	Exposure Risk Assessment
X-Ray equipment found in multiple laboratories in Metals Development, Spedding Hall, and Zaffarano Hall.	Beryllium is a constituent of windows used for cryostats and x-ray beam paths; Be has a low Z value and therefore low absorption.	<p>Negligible; Be is part of window; windows are rarely handled and meet definition of “article.” Service is only conducted by trained individuals utilizing manufacturer instructions.</p> <p>In the unlikely occurrence of a window shattering during handling, beryllium exposure precautions including skin and respiratory protection would be required during cleanup operations.</p>

Type of equipment, locations	Beryllium (Be) Item	Exposure Risk Assessment
Analytical equipment Standards in Spedding Hall B24, B11, B8.	Dilute aqueous Be solutions are used in analytical applications. Typical concentration is 1000 ppm.	Negligible, given the dilute aqueous solutions, infrequent use, and required skin protection, the exposure potential is negligible.
Spedding Hall 133	Beryllium Chloride, Sublimed, 5 g	Laboratory chemical hygiene procedures apply.
Metals Development D104	Beryllium-contaminated PPE Waste in fiber drum	Negligible exposure potential; drum is waiting disposal.
High Pressure Gas Atomization Equipment, Metals Development	Beryllium oxide ceramic tubes (a.k.a. stopper rods) used on high temperature melts for high pressure gas atomization runs.	Negligible. The stopper rod is an article. Beryllium is part of the rod; the rod is not consumed in work, nor is any beryllium-containing material aerosolized.
Building-related contamination, Harley Wilhelm Hall, Metals Development, and Spedding Hall - Interstitial & minimal access laboratory spaces	Residual beryllium contamination exists in utility spaces including sub-basement areas and ventilation shafts. Residual beryllium may also be present in isolated inaccessible horizontal surfaces in laboratory spaces, such as old cable trays located above ceilings.	Minimal; Be surface concentrations are low but above DOE-defined clearance levels. Areas are only accessible to Facilities and Engineering Services workers; PPE requirements are established in the risk assessment of any work conducted in these areas. Respiratory protection is worn when entering these spaces. Breathing zone air monitoring conducted during remediation of ventilation stacks showed no detectable levels of airborne Be.
SPH 258 2016 Inventory	Beryllium x-ray windows (4 Failed, 6 new); BeCu Wire; Old x-ray tubes (4 with total 14 windows); 99.4% Beryllium Scrap (2.48 g); welding test pieces with estimated beryllium 0.3 g; 5 spools BeCu wire, total estimated beryllium @ 3% = 70.626 g)	All are articles. Use or modification of these is not currently planned, so exposure potential is negligible. If use or modification becomes planned, Readiness Review procedures requiring written exposure control plan will apply.

5.10 Regulated Areas (850.26)

Ames Laboratory does not currently have any beryllium-containing/using areas that meet the definition delineated in Section 850.26 (i.e. areas where airborne concentrations are at or above the action level). Some areas, such as the sub-basement of Wilhelm, have areas where surface beryllium concentrations have been measured that are above DOE

clearance levels. These areas are only accessed by FES workers wearing appropriate PPE including respiratory protection.

5.11 Hygiene Facilities and Practices (850.27)

It is not anticipated that hygiene facilities, as defined in Section 850.27, will be necessary. FES employees in the suspect areas already work under the requirements of a Radiological Work Permit (RWP) which includes use of Tyvek® suits and respirators. The RWP includes any potential decontamination issues associated with exiting regulated areas. The protective measures and decontamination procedures for radiological contamination would adequately address beryllium contamination as well.

5.12 Respiratory Protection and Protective Clothing (850.28 & 850.29)

All Ames Laboratory employees who enter areas where surface beryllium contamination has been identified will wear a NIOSH-approved respirator. The requirements of the Laboratory's Respiratory Protection Program will apply, including medical surveillance requirements and periodic fit testing and training. As stated previously, employees entering areas in the Wilhelm sub-basement area with potential surface beryllium concentration are already required to wear a respirator and other protective equipment as a result of meeting the requirements of the Radiological Work Permit. The detailed respiratory protection specification is established based upon the work to be conducted, and will be at minimum a NIOSH-approved P100 or N100 air purifying respirator.

5.13 Housekeeping (850.30)

Section 850.30 requires an employer must conduct routine surface sampling to determine housekeeping conditions in "operational areas of DOE facilities". Operational areas, as defined by the standard, means areas "where workers are routinely in the presence of beryllium as part of their work activity." Ames Laboratory has identified several restricted access areas (utility chases) that have beryllium surface contamination that exceeds the 3.0 microgram per 100 square centimeter removable contamination level established in this section of the standard. Surface sampling for beryllium continues as these areas are accessed for facility renovation. FES employees wear appropriate personal protective equipment when in areas with potential for surface levels exceeding the DOE limit and are under ESH&A surveillance due to radiological issues that are also present.

5.14 Release criteria (850.31)

This section of the standard applies to the cleaning and release of beryllium-contaminated equipment. This section does not currently apply to activities or equipment at Ames Laboratory. In the unforeseen situation that a piece of contaminated equipment is discovered, Ames Laboratory will abide by the requirements of this section.

5.15 Waste disposal (850.32)

Any beryllium-containing waste will be managed in accordance with the Ames Laboratory Waste Management Program.

5.16 Beryllium emergencies (850.33)

The standard defines a beryllium emergency as an event that "results in an unexpected and significant release of beryllium at a DOE facility. Because there are no operations that involve heating, abrading, machining or grinding beryllium-containing materials at the Laboratory, there is no reasonably-foreseeable circumstance in which a beryllium emergency is likely to occur. Therefore, this section is not applicable to Laboratory Operations.

5.17 Medical surveillance (850.34)

The standard requires that Ames Laboratory “establish and implement a medical surveillance program for beryllium-associated workers who voluntarily participate in the program.”

Ames Laboratory FES employees are current workers whose work history indicates that the worker may have been exposed to airborne concentrations of beryllium at a DOE facility, and are therefore included in the medical surveillance program. Medical surveillance services are provided by the Occupational Medicine department in G11 TASF and the Occupational Medicine department is a resource to all employees on any medical questions related to beryllium.

The hazards of laboratory research projects involving the use of beryllium or beryllium compounds are managed through the Readiness Review process and the Chemical Hygiene Plan.

All current and former Ames Laboratory workers, regardless of job assignment, are also eligible for voluntary inclusion in the Beryllium-Associated Worker Registry, which provides testing services at no cost to the worker.

The Occupational Health Manager (OHM) system is the electronic medical records program utilized by the Occupational Medicine Department to maintain records related to medical surveillance. Industrial hygiene information regarding beryllium exposure or potential beryllium exposure is provided to the Occupational Medicine Department for inclusion in the medical records of the worker(s) sampled as well as in the records of workers in a similar exposure group (SEG).

5.18 Medical removal (850.35)

See verbiage in Section 5.17.

5.19 Medical consent (850.36)

See verbiage in Section 5.17.

5.20 Training (850.37)

Awareness training is provided to all occupants of the buildings in which building-related contamination has been identified. Specific training in the contents of this CDBPP and the provisions of 10 CFR 850, including health effects and risks to family members, will be provided to all Beryllium-Associated Workers and any other interested parties. Training is tracked by the training department with updates every two years as required by the standard.

5.21 Warning signs and labels (850.38)

In accordance with this section, warning signs have been placed at each entry to the restricted access areas referenced earlier. Containers of beryllium-containing chemicals in laboratories are labeled in accordance with the Hazard Communication Standard (29 CFR 1910.1200). Areas such as interstitial spaces and ventilation systems with beryllium contamination above relevant DOE limits are placarded with beryllium-specific hazard information.

6.0 POST PERFORMANCE ACTIVITY

6.1 Recordkeeping and use of information (850.39)

All recordkeeping or documentation related to the beryllium inventory, hazard assessments, exposure measurements and controls will be maintained by the ESH&A industrial hygiene staff. All recordkeeping or documentation related to medical surveillance will be maintained by the Occupational Medicine department. The Industrial Hygienist will provide exposure measurement data for individual workers or those identified as members of a sampled SEG to the Occupational Medicine Department for inclusion in the OHM system. This will permit the Occupational Medicine department to readily access this information when conducting medical assessments.

6.2 Performance feedback (850.40)

The standard requires that the employer “conduct periodic analyses and assessments of monitoring activities, hazards, medical surveillance, exposure reduction and minimization, and occurrence reporting data.” This review will be conducted annually by ESH&A Industrial Hygiene and posted to [Ames Laboratory Beryllium Information Page](#) by March 31 of the following year.